PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

1841. No. 19.

Monday, 1*st March* 1841.

The Right Hon. Lord GREENOCK, V.P., in the Chair.

The following Communications were read:—

1. On the Sea-Level of the Neapolitan Coast. By Sir John S. Forbes, Bart.

This paper is intended to give an account of the more recent researches of the Italian antiquaries and geologists connected with the well-known temple of Jupiter Serapis at Pozzuoli, which have been verified in several particulars by the author, by personal inspection, and extended to other parts of the western coast of Italy, where traces of marine lithophagi have been found at a height, as alleged by Niccolini, of even 250 feet above the present sea-level.

The most interesting modern observations are those of Niccolini on the actual change of relative level of the sea and land, ascertained by a fixed gauge which he has observed frequently between 1823 and 1838. In that time the land appears to have risen through a height of 112 millimetres or 4½ inches; and this change has been progressively and not suddenly effected.

2. On the Supposed Progress of Human Society from Savage to Civilized Life, as connected with the Domestication of Animals and the Cultivation of the Cerealia. By John Stark, Esq.

The object of this paper is to controvert the generally received opinion, derived from the classical writers, and adopted by most philosophers, that human society, in its original state, was one of savage barbarism; and, that, in the supposed progress from savage to civilized life, three separate stages or gradations have been gone through, the one leading necessarily to the other. These stages,—or the *hunter's life*, when the food of man was procured by the chase of wild animals, the *pastoral state*, when flocks and herds formed his chief support, and the *agricultural state*, when grains were cultivated,—the author shews never had any existence, except in the fancies of poets or the theories of philosophers.

1. In regard to the assumption that man was created a dumb savage, the author states, that such a supposition is neither reconcilable with probability, nor consonant to reason, nor warranted by historical records. If he had been originally dumb, his race never could have acquired the power of speech; if he had been merely a frugivorous animal, his instinctive propensities would never have led him to feed on animals; and if such animals were his destined prey, it could never happen, in the ordinary course of things, that he was to become their protector. If he had been created a savage, a savage he must ever have remained.

2. With regard to the domestication of animals originally wild, according to the theories of poets, philosophers, and historians, who supposed this to have been the result of ages of experiment—an assumption which has remained uncontroverted till now—the author shews that the supposition of the domesticated races ever having been in a wild state, is not warranted by any thing recorded in sacred or profane history; that, as far as human history extends, the domesticated animals were man's companions; and that an instinct of sociability, or a particular disposition to dwell with men, exists in the nature of these animals, without which all attempts to tame them would have been in vain. The animals known as domestic were so from the earliest periods, and no addition to their number has been made through successive ages.

3. The cultivation of the *Cerealia*, which, according to the philosophical theory, was an invention of civilized man, and the result likewise of ages of experiment,—the author asserts to be an assumption without the shadow of foundation. He proved, from recorded facts, that the cultivated grains are nowhere found growing in a wild state to any useful extent; that they die out in a very few years when left to the care of nature alone; that their existence depends upon their continued cultivation, and that their cultivation was known to the progenitors of the human race.

The author considers himself to have established these propositions, 1. That man was at his creation a civilized being, endowed with all the physical and intellectual powers necessary to his state as a moral and intellectual agent; 2. That the domestic animals were created for his use, and obedient to his will from the beginning; 3. That the cultivation of the Cerealia was the earliest occupation of the human race; 4. That prior to the Deluge cities were founded and many of the useful arts practised; and, 5. That the survivors of the Deluge started with all the knowledge of their predecessors, the possession of the domestic animals, and the grains necessary to their processes of agriculture.

In place of the supposed gradation from savage to civilized life, the author asserts, from the history and monuments of all ages and nations, that the general tendency of the race is to degenerate from a civilized to a barbarous state of society. And that the desolation of the mightiest kingdoms and republics of antiquity,—their ruined cities and neglected fields,—teach the lesson, that neither science nor art, neither philosophy nor religion, has hitherto been effective in stopping this downward progress,—this descent to barbarism and savage life.

The following Donations were presented:—

The Quarterly Journal of Agriculture, and the Prize-Essays and Transactions of the Highland and Agricultural Society of Scotland, for March 1841.—*By the Highland and Agricultural Society.*

On the Constitution of the Resins. Parts 4 and 5. By James F. W. Johnston, Esq., A.M., F.R.S.—*By the Author.*

15*th March*, 1841.

Dr ABERCROMBIE, V.P., in the Chair.

1. On the Parallel Roads of Glen-Roy, with an Examination of Mr Darwin's Theory of their Formation, Part I. By Sir T. D. Lauder, Bart.

2. On the Polarizability of Heat from different Sources. By Professor Forbes.

The author of this paper states in it his belief, that the curious fact formerly announced to the Society of the greater permeability of mica, laminated by heat, to heat of low temperature, contrary to the usual character of the same substance (a property which he has since extended (see Proceedings, Jan. 1840) to changes of mechanical conditions of surface), may very probably explain, as M. Melloni anticipates, the difference in point of fact long contested between them as to the equal or unequal polarizability of heat from different sources.

3. Account of the Fossil Species of the genus *Solarium*, Lamarck, found in the Supercretaceous group in Italy. By M. le Chev. Michelotti of Turin. Communicated by Dr Traill.

This genus of shells belongs to the Class GASTEROPODA of Cuvier, and to the family TURBINACEA of Lamarck, of which the general character is to have the shell turreted or conoid, with the aperture rounded or oblong, and the margin disunited.

M. Michelotti was induced to undertake the examination of the fossil Italian species of this genus, from the doubts prevailing regarding the identity of some of the species in the writings of authors. He describes in all ten species, which are found in the neighbourhood of Turin, of which four have not been previously noticed. The four newly described species are *Solarium neglectum*, *S. pulchellum*, *S. Lyellii*, and *S. humile*. Two of the other species described, viz. *S. Stramineum*, Lamarck and *S. luteum*, have their living prototypes,—the first in the Indian and Mediterranean Seas, and the second in the seas of New Holland. The other species are,—

Solarium pseudo-perspectivum, Brocchi.
..... umbrosum, Brongniart.
..... millegranum, Lamarck.
..... canaliculatum, Lamarck.

In illustration of his paper, M. Michelotti has sent drawings of each of the species he describes, in three different positions, so as to shew all the characters of the shell. The references to authors who have mentioned the species (or synonyms) seem very complete

The following Donations were presented :—

Journal of the Asiatic Society of Bengal. No. 100. 1840.—*By the Society.*

Mittlere Vertheilung der Wärme auf der Erdoberfläche, nebst Bemerkungen über die Bestimmung der mittleren Temperatur. Von Wilhelm Mahlmann.—*By the Author.*

Memorie della Reale Accademia delle Scienze di Torino. (Serie Seconda). Tomo ii.—*By the Academy.*

Philosophical Transactions of the Royal Society of London for the year 1840. Parts 1, 2.—*By the Royal Society.*

Proceedings of the Royal Society 1840. Nos. 41, 42, 43, 44, and 45.—*By the Royal Society.*

Report of the Ninth Meeting of the British Association for the Advancement of Science, held at Birmingham in August 1839.—*By the British Association.*

A Supplementary Report on Meteorology, presented to the Meeting of the British Association in 1840. By Professor Forbes. —*By the Author.*

5*th April*, 1841.

Sir T. M. BRISBANE, Bart., G. C. B., Pres., in the Chair.

1. On the Parallel Roads of Glen-Roy, with an Examination of Mr Darwin's Theory of their Formation, Part II. By Sir T. D. Lauder, Bart.

This paper consists of a critical investigation of a recent paper by Mr Darwin upon this subject, and the author's object is to prove that Mr Darwin's views are untenable; and that his own explanation of the appearances in Glen-Roy, given in his paper

in the Transactions of this Society, and ascribing them to successive subsidences of a fresh-water lake, is still the only view reconcilable with the facts.

James Spittal, M.D., Fellow of the Royal College of Physicians of Edinburgh, was duly elected an Ordinary Fellow.

2. On the Visibility of rapidly revolving Lights, made in reference to the Improvement of Light-Houses. By Alan Stevenson, LL.B., Civil Engineer.

These experiments consisted in a comparison of the visibility of lights from lenses when at rest, and when revolving with such rapidity as to produce an apparently continuous impression on the sense of sight. They were undertaken at the suggestion of Captain Basil Hall, who had himself in the spring of last year made some trials of a similar kind, in the expectation that the eye would be so stimulated by the bright flashes, that not only the almost imperceptible intervals of darkness would have no effect in impairing the visibility of the rapidly recurring flashes, but likewise the eye would actually be stimulated by the contrast of light and darkness, in such a manner that the effect of the rapid series would be greater than that of the same quantity of light equally distributed over the whole horizon by the refracting zones at present used in fixed lights, which only refract the light in the vertical direction, without interfering with its natural horizontal divergence. Mr Stevenson shewed that this expectation was at variance with what would be predicted from a consideration of the laws of the physical distribution of the light; and the experiments proved that the visibility of the rapidly revolving series was greatly inferior, not only to that of the lens at rest, but also to that of the light equally distributed by the refracting zones. From the results of the experiments, the author drew the following general conclusions:—

1. That continuity of impression in the sense of sight is scarcely obtained by producing ten flashes in a second of time; and that the visibility of the light decreases in a most remarkable degree with the velocity of the series.

2. That this decrease of visibility, although partly owing to a loss of intensity, is chiefly caused by deficiency of volume in the visual object, which at the most rapid velocity became so small

that few observers at the distance of fourteen miles could detect it with the naked eye, while the light from the zones was large and distinct.

3. That the rapid passage of the visual object over the eye causes this decrease in its volume, by diminishing the amount of irradiation, which, according to the theory of M. Plateau, is, within certain limits, proportionate to the duration of the impulse of light in the retina.

The following Donations were presented :—

Mémoire de la Société Géologique de France. Tome iv. P^tie^ 1. —*By the Society.*

The Transactions of the Royal Irish Academy. Vol. xix. Part 1. —*By the Academy.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. 1841. Nos. 6, 7, 8, 9, 10.—*By the Academy.*

Proceedings of the Geological Society of London. Nos. 74 and 75.—*By the Society.*

The American Journal of Science and Arts. Conducted by Professor Silliman ; for January 1841.—*By the Editor.*

E'tudes Géologiques dans les Alpes. Par M. L. A. Necker, Tome i.—*By the Author.*

Maps of the Ordnance Survey of England and Wales. Nos. 75, 76, 79, and 82.—*By the Board of Ordnance.*

19*th April* 1841.

The Right Hon. Lord GREENOCK, V. P. in the Chair.

The following Communications were read :—

1. On the Theory and Construction of a Seismometer—an instrument for Measuring Earthquake Shocks and other Concussions. By Professor Forbes.

The plan of this instrument was submitted amongst others to a Committee of the British Association appointed to devise means for registering earthquake shocks. A heavy pendulum, suspended from a frame, will evidently have its bob left behind by its inertia when the frame is moved forwards by any concussion. To render such an instrument very sensible, however, the pendulum must be of great length, which presents many inconve-

niences in practice. The author, therefore, proposed an inverted pendulum, sustained by a steel wire, on the principle of the noddy invented by Mr Hardy, for ascertaining the stability of clock cases. The balance of gravity and elasticity (which act, the former to displace, the latter to redress, the pendulum) may be rendered as nice as we choose, and hence the sensibility of the instrument is wholly independent of its dimensions.

The author has shewn, by a mathematical investigation, that the extent of deviation due to a given concussion, within moderate limits, depends solely upon the time of vibration of the pendulum,—that, for any sudden forward motion of the machine, the greatest displacement of the bob of the pendulum may become equal to that motion,—but if the motion continue uniformly for a short space and then cease, the displacement may be doubled in amount.

The self-registering part of the apparatus consists of a pencil at the extremity of the inverted pendulum, which travels over a prepared concave surface of paper, and marks at once the direction and extent of the displacement of the pencil, which is evidently contrary to the movement of the ground. The author also points out how, by varying the position of the bob upon the rod of the pendulum, and at the same time altering the elasticity of the spring, the deviation of the pencil may be increased in any proportion to the actual movement of the ground, and this irrespectively of the dimensions of the instrument.

Lastly, he shews how, by employing two instruments of the same kind, but *whose sensibility* (determined by the time of one vibration) *differs in a known proportion*, the duration of a shock and the extent of lateral movement of the ground may be calculated; and he gives a table for this purpose. It is to be understood, however, that this and other results of the mathematical investigation are only true in so far as the fundamental hypothesis is correct,—viz. that an earthquake is a lateral movement of the ground in one direction, through a short space, and with a uniform velocity.

Similar instruments might, no doubt, be applied to measure the lateral concussions of railway trains.

2. On the Circulation of the Blood, and the Difference of the Laws of Fluids moving in living and dead tubes. Part I. By Sir Charles Bell.

The author commenced with a eulogy of Mr Hunter, and of his experiments upon the arteries; and proceeded to illustrate the elasticity and muscularity of an artery.

The author's experiments were made on the human frame, by taking advantage of the amputated limb on the instant of its separation from the body. He made a section of the artery so as to present a piece in the form of a ring,—he slit this ring, and it sprang open to a certain extent. Putting it in water, it was found in the morning reversed or bent the other way. On taking a larger portion of the artery, which was straight, and slitting it up, it immediately bent backwards in a semicircular form.

The author gave this explanation of these facts:—On the circular portion of the artery being cut up, the elastic power prevailed to a certain degree; but continuing to be opposed by the circular muscular fibres until the vital power was exhausted, then the elasticity so entirely prevailed as to bend the ring in the reverse position.

But on slitting up the long straight piece of the artery, it immediately curled back, for there are no longitudinal muscular fibres to prevent the elasticity having instant effect.

The author then went into a description of the different mode and time of action of the muscular fibre, shewing that we must not retain the idea first presented to us in the voluntary muscles, but contemplate the same property of action in the muscular fibre, where it enters into the composition of particular organs, and when it is made subservient to the function, acting in a different time and mode, and being sometimes not excitable by acrid or mechanical stimulus: hence inferring, that we must not expect to excite the muscular coat of an artery by irritating it as we might do a voluntary muscle.

The author took a portion of an artery of a square form, and found that, by appending weights, it was equally elastic in all directions; on which he argued,—Since the artery is full of blood when it receives the systole of the heart, on the acknowledged laws of hydraulics, that an impulse upon fluids is propagated equally in all directions, it must follow that the artery dilates in the transverse as well as the longitudinal direction.

He proceeded to shew, that, as the artery is elastic, the impulse of the heart cannot reach every branch at the same moment,—that undulations, or partial distention, must characterize the progress of the heart's impulse along the artery.

He argued against the opinion that there is no other quality than that of tonicity in the circular fibres of the artery. For tonicity, according to the definition of physiologists, being a permanency of action, which admits of no relaxation, it would follow that the artery had two properties exactly the same; for tonicity and elasticity would present exactly the same kind of resistance to the blood impelled by the heart.

But,—granting to these fibres the vital property of muscularity,—since the healthy action of a muscular fibre is characterized by relaxation as much as by contraction, we perceive that the higher muscularity of the extreme vessels implies that they are more easy of dilatation, as well as more powerful in contraction; and that the dilatation and contraction of successive portions of the artery must, like an increasing wave, bestow a higher degree of activity in the vessels remote from the heart. Sir Charles deferred the reading of the Second Part of his paper.

The following Donations were presented:—

The Transactions of the Linnean Society of London. Vol. xvii. Parts 2, 3, 4; and Vol. xviii. Part 1.

The Proceedings of the Linnean Society of London. Nos. 8 and 9.—*By the Society.*

Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce. Vol. liii. Part 1.—*By the Society.*

Journal of the Asiatic Society of Bengal. Nos. 99, 101, and 102.—*By the Society.*

Travels in the Himalayan Provinces of Hindustan and the Punjab. By William Moorcroft and George Trebeck. Edited by H. H. Wilson, Esq. 2 vols. 8vo.—*By the Asiatic Society of Bengal.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences. Tome x. Nos. 19 to 26; Tome xi. and Tome xii. Nos. 1 to 5.—*By the Academy.*

Mémoires de l'Académie Royale des Sciences de l'Institut de France. Tomes xiv. xv. xvi. and xvii.

Mémoires présentés pars divers Savants à l'Académie Royale de l'Institut de France. Tome 5.—*By the Academy.*

Voyage dans la Russie Méridionale et la Crimée. Par M. de De-

midoff. (Partie Scientifique.) Livr^ns xiii. et xiv. des planches. —*By the Author.*

Transactions of the Zoological Society of London. Vol. i. Part 3.

Proceedings of the Zoological Society of London. Nos. 73 to 90. —*By the Society.*

3d May 1841.

Right Hon. Lord GREENOCK, V.P., in the Chair.

The following Communications were read:—

1. Experimental Researches on the Production of Silicon from Paracyanogen. By Samuel Brown, M.D. Communicated by Dr Christison.

In his paper on Paracyanogen read to this Society at an earlier period of the present session, the author announced that he considered he had succeeded in proving, that two familiar bodies, universally believed to be distinct elements, are modifications of one and the same elementary form. In the present paper, he announced that the bodies in question are carbon and silicon, and gave a detailed statement of the investigations by which he had been led to this conclusion.

1. Silicon may be obtained from uncombined paracyanogen.—When paracyanogen, prepared from bicyanide of mercury by heat under pressure, as described in his former paper, was subjected to prolonged heat in a closed tube of German glass, a dark-brown substance was obtained, which presented all the diagnostic characters of silicon. More especially, it was incombustible before the blowpipe, underwent no change on being projected into fused chlorate of potash, but dissolved with effervescence in fused carbonate of potash, forming a white saline substance, in which silica was detected by its ordinary reagents. The same experiment was performed with the like result on a larger scale in a porcelain crucible; and the quantity of silicon produced came within a very small amount of the carbon contained, by theory, in the paracyanogen employed. When paracyanogen is heated with carbonate of potassa, silicic acid is obtained at once. A variety of experiments were described, the purpose of which was to obviate all fallacy that might be supposed to arise from silica being present in the vessels employed.

2. Siliciurets may be obtained by the reaction of paracyanogen on metals.—When bicyanide of mercury was heated in tubes

of copper or iron in the way followed for obtaining paracyanogen, the interior of the tubes was found to be lined with scales, which consisted, not of paracyanide or carburet of these metals, but of their siliciuret. And when paracyanogen was heated in a platinum crucible several times in succession till the crucible would absorb nothing more, a compound was obtained which was a siliciuret of platinum, containing four per cent. of silicon.

3. When paracyanogen is decomposed in the preceding experiments, the nitrogen given off corresponds with what is contained by theory in the compound which yields it. A variety of experiments of analysis were mentioned to this effect; from which a further corroboration was derived of the conclusion derived from the author's previous researches, that the silicon could come only from the carbon of the paracyanogen.

4. A siliciuret may be obtained from the paracyanide of iron. Under this section, the author first described the process by which a pure paracyanide of iron may be obtained from ferrocyanide of potassium; and stated that he had found this compound to consist of one equivalent of nitrogen, two of carbon, and one of iron. He then observed that he had been led to suppose this compound to be the true compound radicle of the so-called ferrocyanides; on which subject he proposed to make ere long a distinct communication to the society. He next proceeded to explain the results of numerous experiments on the influence of heat on the paracyanide of iron; from which it appeared that, under a high temperature and pressure, a compound was obtained, in which carbon could not be detected, but instead of it silicon, in the proportion of 28.5 per cent. To these remarks were added others on ferrocyanide of potassium, which he considers to be resolved in the process into cyanide of potassium evolved by sublimation, and paracyanide of iron, which at the same time is decomposed, and yields disiliciuret of iron. The product obtained in these two ways is in general partly in the form of a coaly powder, partly in fused obsidian-like masses. But if the ferrocyanide of potassium be heated with its own weight of cyanide of potassium, as a non-reactive flux, the disiliciuret is obtained in a semicrystalline form, which in fine powder is colourless, and is seen before the microscope to be transparent like glass; and sometimes there is an approach to a crystalline form, nay, small particles may be discovered with the microscope which are regular octahedres. The disiliciurets of iron thus produced were treated of by the author in

his Inaugural Dissertation in 1839, as carburets of the metal. (See Trans. Brit. Assoc. 1839, vol. ix.) Experiments were added under the present section, which satisfied the author that every conceivable source of silicon, except from the paracyanogen, was provided against by the manner in which the experiments of conversion were performed. Among other facts thus elicited, it appeared, that, by successive operations in the same vessel, a greater weight of disiliciuret of iron might be obtained than the weight of the vessel itself.

5. Silicic acid may be obtained by a direct process from the paracyanide of iron. The conversion thus accomplished might appear, as the author conceived, more satisfactory to most persons, than any of the previous operations, on account of the large scale on which the experiments were performed. When paracyanide of iron was mixed with four times its weight of carbonate of potash, and ignited in a shut crucible of hammered iron for four hours at a full white heat, a rose-red saline product was formed, from which a transparent solution was obtained with water; and when this was supersaturated by hydrochloric acid, a bulky precipitate was thrown down, which, when purified from adhering metallic oxide by fusion with carbonate of potash, solution of the product in water, neutralization with hydrochloric acid, evaporation, desiccation, and ignition, and elutriation with water to remove chloride of potassium,—presented all the distinctive characters, physical as well as chemical, of silicic acid. Five grains of paracyanide of iron thus gave 3.04 of silicic acid; and 30 grains of ferrocyanide of potassium, similarly treated, gave 5.4 grains of silicic acid. The iron crucible used in these operations did not yield a particle of silicic acid when heated to a white heat with pure carbonate of potash,—the same salt employed in the preceding cases of conversion. A large crucible was worked seven successive times with 9334 grains in all of ferrocyanide of potassium; and 1240 grains of silicic acid were produced.

The author added that, in the course of several of these operations, more especially those of the last section, he found the iron to undergo conversion as well as the carbon; and in a subsequent paper he proposes to state in detail the facts which lead him to the conclusion that this metal is a variety of the same elementary form with rhodium.

2. On the Anatomy of the *Amphioxus lanceolatus* of Yarrell. By John Goodsir, Esq. Communicated by Professor Syme.

After a short statement of the labours of Yarrell, Couch, Retzius, and Müller, the author gave a detailed description of the structure of *Amphioxus*, as observed in the dissection of one of two specimens taken by Mr Forbes in the Irish Sea. The abdominal folds, and the anterior and posterior anal fins, were described, and the existence of a fin in front of the anus illustrated by an observation made by Professor Agassiz, of the temporary existence of a similar fin in the embryos of certain fresh-water fishes.

The osseous system presented two divisions,—the true or neuro-skeleton, and the intestinal or splanchno-skeleton. The true skeleton consisted of a chorda dorsalis, equally pointed at both extremities, without the slightest trace of a cranium, and destitute of any of the peripheral vertebral elements, with the exception of a row of cells—germs of interspinous bones and fin-rays—along the base of the dorsal and anal fins. The tissue of this neuro-skeleton was not even cartilaginous, consisting merely of membrane and globular nuclei, derived from the original elementary cells. The splanchno-skeleton consisted of a hyoid apparatus, and of 70 to 80 pairs of elastic filamentous ribs. The hyoid apparatus—in two divisions, with 17 pieces in each—exhibited 34 rays, pointing inwards, and each springing from one of the 34 basal elements of the hyoid bone. These rays the author looked upon as developments of the tubercles and teeth of the central aspect of the branchial apparatus of the higher fishes, and not as branchiostegal rays. The ribs were enveloped in the mucous membrane of the intestine, and each alternate pair bifurcated below, to enclose the abdominal longitudinal vessel or heart. From these circumstances, and from other considerations, the author looked upon the ribs of *Amphioxus* not as true ribs, but as splanchno-ribs—repetitions of the hyoid bone—analogues of the tracheal and bronchial cartilages of the higher Vertebrata. The tissue of the splanchno-skeleton is more advanced than that of the neuro-skeleton; the ribs are cartilaginous; the hyoid bones hollow cartilages, with isolated cells or nuclei in their interior.

The nervous system presents nothing more than a spinal cord, without a trace of cerebral development, and from 60 to 70 pairs of spinal nerves. The spinal cord was in the form of a ribbon, pointed at both ends, with a dorsal median groove, and a line of black or grey matter; was composed of nucleated cells, without

tubes or fibres, and gave origin to the nerves in single roots only. The nerves were all symmetrical, dividing into dorsal and ventral branches. The second pair sent back a dorsal and a ventral branch, to join the corresponding branches of the other nerves, along the sides of the body, and along the bases of the dorsal and anal fins; from which distribution the author was inclined to believe, that although the second pair in *Amphioxus* presented certain resemblances to the vagus, it was, in reality, the trifacial.

The vascular system consisted of a straight abdominal vessel, the branchial artery or heart, without any trace of valves or division into cavities. This vessel sent off lateral branches, which, passing up on the internal surface of the intestine, along the ribs, communicated by a capillary respiratory system of vessels with a dorsal trunk or aorta.

The intestinal tube was straight from mouth to anus, its anterior half dilated, strengthened by ribs as described above, and its entrance guarded by the hyoid rays. This dilated portion of the canal received sea-water, as in the *Ascidiæ*, to act on the respiratory vascular ramifications on its internal surface, which is undoubtedly ciliated in the living animal. The digestive portion of the canal is narrow, and presents not a trace of a liver, or of any other assistant chylo-poietic viscus.

As there was no trace of branchial fissures—as the ribs were too numerous to be looked upon as true branchial arches (branchial arches alternating with branchial fissures)—and as the other organic systems were in the condition of those of an embryo before the appearance of branchial clefts, the author was led to the conclusion that the *Amphioxus* had never had, at any period of its existence, branchial clefts;—that it was an animal which had arrived at its perfect development before the branchial clefts had appeared, and, consequently, with an undeveloped osseous and nervous system, without a liver, and with an unilocular heart.

After examining the generative organs, and other departments of its anatomy, the author entered upon the consideration of the zoological position of *Amphioxus*, which he observed could no longer be ranked with *Petromyzon* and *Myxine*, but must take an ordinal place in any new arrangement of the class. In conclusion, he remarked, that although genera allied to *Amphioxus* might now be rare, yet in the ages which have passed since the development of organic forms commenced, *Abranchiated* fishes may have been more common, and may yet afford subjects of research to the palæontologist